

Patent Claims

1. Process for the darkening of a surface layer of a piece of material containing zinc, for the purpose of anodic oxidation of the piece of material in a dipping bath which contains a hydrous solution of a hydroxide, characterized by
 - the dipping bath having a pH value within the range from 8 to 14,
 - the dipping bath temperature (T) being within the range from 15 to 45°C,
 - the current density (i) for anodic oxidation being within the range from 3×10^{-4} to 0.5 A/cm²,
 - the piece of material being dipped into the bath at the beginning of anodic oxidation when voltage has already been fed.
2. Process according to Claim 1, characterized by
 - the process being carried out with direct current with a current density within the range from 2 to 30 mA/cm².
3. Process according to Claim 1, characterized by
 - the dip bath solution containing an alkali or ammonium salt,
 - the concentration of alkali or ammonium salt being within the range from 10 to 60 g/l, and...

- the alkali or ammonium salt being selected from among the group comprising phosphates, acetates, carbonates, sulphates, oxalates, citrates, and borates of alkali metals or ammonium.
- 4. Process according to Claim 3, characterized by the pH value being set by means of an adequate concentration of NaOH or KOH.
- 5. Process according to one of the Claims 3 or 4, characterized by being carried out at a pH value exceeding 13.
- 6. Process according to one of the Claims from 3 to 5, characterized by anodic oxidation being executed during a period of treatment (t) of between 1 second to 10 minutes.
- 7. Process according to Claim 6, characterized by anodic oxidation being executed over a period of treatment (t) of between 30 seconds to 3 minutes.
- 8. Process according to one of the Claims from 3 to 7, characterized by being carried out with direct voltage.
- 9. Process according to Claim 8, characterized by the dipping bath temperature being within the range from 15 to 30°C, and the current density (i) being within the range from 3×10^{-4} to 0.15 A/cm².
- 10. Process according to Claim 9, characterized by the current density (i) being within the range from 0.3 to 20 A/cm².
- 11. Process according to one of the Claims from 8 to 10, characterized...

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Sub A3
...by the dipping bath containing from 25 to 35 g/l NaOH and from 30 to 50 g/l NaNO₃ or Na₂B₄O₇.

12. Process according to Claim 11, characterized by the dipping bath containing 30 g/l of NaOH and 40 g/l of NaNO₃ or Na₂B₄O₇.

Sub A4
13. Process according to one of the Claims from 3 to 7, characterized by being carried out with alternating voltage.

14. Process according to Claim 13, characterized by the dipping bath temperature being within the range from 35 to 45°C, and the current density (i) being within the range from 0.1 to 0.15 A/cm².

Sub A5
15. Process according to Claim 13 or 14, characterized by the dipping bath containing from 10 to 35 g/l NaOH and from 30 to 60 g/l NaNO₃ or Na₂B₄O₇.

16. Process according to Claim 15, characterized by the dipping bath containing from 25 to 35 g/l NaOH and from 40 to 50 g/l NaNO₃ or Na₂B₄O₇.

Sub A6
17. Process according to one of the Claims 13 to 16, characterized by the dipping bath containing from 10 to 15 g/l of NaOH and from 10 to 60 g/l of an alkali salt being selected from among the group comprising phosphates, acetates, carbonates, sulphates, oxalates, citrates, and borates of alkali metals.

18. Process according to one of the Claims from 1 to 17, characterized by the piece of material being subjected to a dipping treatment in an acid prior to anodic oxidation.

19. Process according to Claim 18, characterized by the use as an acid of H_2SO_4 of a minimum of 0.5 M, and the dipping treatment being carried out over a period of at least 10 seconds.
20. Process according to Claim 18, characterized by the use as an acid of H_2SO_4 of 2 M, and the piece of material being tempered after dipping treatment at approx. 200°C over a period of approx. 1 hour.
21. Process according to one of the Claims from 1 to 20, characterized by the piece of material being subjected to dipping treatment in an acid after anodic oxidation.
22. Process according to Claim 21, characterized by the use of 10% percentage CH_3COOH as an acid, and the dipping treatment being carried out for a minimum period of 30 seconds.
23. Process according to one of the Claims from 1 to 22, characterized by the surface layer being provided with a coating thickness of a minimum of $8\text{ }\mu\text{m}$.
24. Process according to one of the Claims from 1 to 23, characterized by the surface layer containing at least 50 % in weight of zinc.
25. A piece of material with a surface layer containing zinc, produced according to a method according to one of the Claims 1 to 24.
26. Process for the darkening of a surface layer made of ZnFe of a piece of material, during which the piece of material is subjected to a treatment in a dipping bath containing a hydrous solution of a hydroxide and a...

27. Process according to Claim 26, characterized by the pH value of the bath exceeding 13, the bath temperature being within the range from 15 to 25°C, and the treatment period being minimum 10 seconds.

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